

# Riverside Energy Park

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## Environmental Statement

### Chapter 13: Ground Conditions

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**Document Reference 6.3 - Appendices**

- Appendix I.1 – Phase 1 Ground Conditions Assessment (2018a)
- Appendix I.2 – Phase 2 Ground Conditions Assessment (2018b)

## 13 Ground Conditions

### 13.1 Introduction

- 13.1.1 This Chapter considers the potential significant effects from ground conditions and disturbance of potentially contaminated ground during the construction, operation and decommissioning of the Proposed Development. It considers potential effects from contamination and ground conditions on human health and the environment including controlled waters, as well as the effects of potentially contaminated ground or groundwater on the Proposed Development.
- 13.1.2 This Chapter has been prepared by Peter Brett Associates LLP (PBA). In accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the Infrastructure EIA Regulations 2017). A statement outlining the relevant expertise and qualifications of the competent experts appointed to prepare the Environmental Statement (ES) is provided in **Appendix A.2**.
- 13.1.3 Baseline conditions for the Riverside Energy Park (REP) site have been identified primarily using a Phase 1 Ground Condition Assessment (GCA), and a Phase 2 GCA, undertaken by PBA in 2018 (referenced as 2018a and 2018b respectively), which present information on the geotechnical and geoenvironmental setting of the REP site. The assessments are included as **Appendices I.1, and I.2**.

### 13.2 Legislation, Policy, Guidance and Standards

#### Legislation

- 13.2.1 UK legislation on contaminated land is principally contained in Part 2A of the Environmental Protection Act 1990. This introduced a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment. The broad approach, concepts and principles with respect to land contamination management in Part 2A should be applied in the determination of planning applications. Part 2A focuses on the identification and remediation of land which in its current use poses an unacceptable risk to people or the environment.
- 13.2.2 The assessment of risk arising from contamination and remediation requirements should be considered on the basis of both the current and proposed use. The underlying approach to identifying and dealing with risk and the broad policy objective of safeguarding human health and the environment are similar for both the planning system and Part 2A.

13.2.3 The Regulations and Statutory Guidance that accompany the Environmental Protection Act 1990, include the Contaminated Land Statutory Guidance for England 2012 and the Contaminated Land (England) Regulations 2006, which have been revised with the issue of The Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263). The guidance includes a definition of 'risk', where a risk is said to be a combination of "*(a) the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land; and (b) the scale and seriousness of such harm or pollution if it did occur*".

13.2.4 The Environmental Damage (Prevention and Remediation) Regulations 2015 implement the European Environmental Liability Directive (2004/35/EC). The Regulations provide that, for certain activities, where there is an imminent risk of environmental damage, steps must be taken to prevent such damage. If environmental damage has already occurred; the Regulations stipulate that the operator of the activity must prevent further damage. The provisions include enforcement procedures including criminal sanctions for breaches of the Regulations.

13.2.5 The Environmental Permitting (England and Wales) Regulations 2016 have replaced those parts of the Water Resources Act 1991 that relate to the regulation of discharges to controlled waters (including groundwater). Controlled Waters are rivers, estuaries, coastal waters, lakes and groundwaters, but not perched waters. Under the 2016 Regulations, groundwater activities relate to inputs of pollutants to groundwater.

13.2.6 The Environmental Permitting Regulations 2016 clarify four objectives that specifically relate to groundwater quality in the Water Framework Directive (2000/60/EC):

- Achieve 'Good' groundwater chemical status by 2015, commonly referred to as 'status objective';
- Achieve Drinking Water Protected Area Objectives;
- Implement measures to reverse any significant and sustained upward trend in the concentration of any pollutant, referred to as 'trend objective'; and
- Prevent or limit the inputs of pollutants into groundwater, commonly referred to as 'prevent or limit' objectives.

13.2.7 The Water Act 2003 (Commencement No.11) Order 2012 brought into effect the definition of contaminated land, to mean only 'significant' pollution of controlled waters.

## National Planning Policy

### National Policy Statements

13.2.8 As outlined in **Chapter 2**, the relevant National Policy Statements (NPS) provide the primary basis for decisions by the Secretary of State on development consent applications for nationally significant infrastructure projects.

13.2.9 Government policy on land contamination aims to prevent new contaminated land from being created and promotes a risk-based approach to addressing historical contamination. With regard to historical contamination, regulatory intervention is held in reserve for land that meets the legal definition of ‘contaminated land’ and poses an unacceptable risk that cannot be dealt with through any other means, including through planning.

13.2.10 The National Policy Statements set out national policy on applications for energy infrastructure (NPS EN-1), renewable energy infrastructure (NPS EN-3); and, the electricity transmission and distribution network (NPS EN-5). These policy statements require that developments should be subject to project level assessments, including a requirement for EIA, to address location specific effects. The NPSs set out assessment principles associated with pollution control and geological conservation.

13.2.11 **Table 13.1** below identifies the relevant requirements of the NPSs:

Table 13.1: Relevant requirements of NPSs

Requirement of NPS EN-1, Overarching National Policy Statement for Energy	Response within this ES
<p>At paragraph 4.10.3, NPS EN-1 states:</p> <p><i>“In considering an application for development consent, the IPC should focus on whether the development itself is an acceptable use of the land, and on the impacts of that use, rather than the control of processes, emissions or discharges themselves. The IPC should work on the assumption that the relevant pollution control regime and other environmental regulatory regimes, including those on land drainage, water abstraction and biodiversity, will be properly applied and enforced by the relevant regulator. It should act to compliment but seek to duplicate them.”</i></p>	<p>The evidence base for the baseline conditions outlined in this ES includes a Phase 2 GCA that contains a Tier 2 quantitative risk assessment. This risk assessment uses site specific information to identify pollutant linkages (on a source-pathway-receptor basis) and potential remediation options. This is based on the premise of being suitable for use and addresses whether the development is an acceptable use of the land from a contamination perspective.</p>

13.2.12 It is considered that this Chapter fully addresses the requirements of the NPSs in relation to ground conditions as outlined above in **Table 13.1**.

13.2.13 Discussion on the below listed National, Regional and Local policy specific to this Chapter is located in **Appendix A.3**.

#### **National Policy and Strategies**

- Revised National Planning Policy Framework (2018);
- National Planning Practice Guidance (PPG) (online resource); and
- National Planning Policy for Waste (NPPW) (2014).

#### **Regional Planning Policy and Strategies**

- The London Plan (2016); and
- London Plan: Sustainable Design and Construction SPG (2014).

#### **Emerging Regional Planning Policy and Strategies**

- Draft London Plan showing Minor Suggested Changes (2018).

#### **Local Planning Policy and Strategies**

- Bexley Core Strategy (2012);
- Bexley Unitary Development Plan ('UDP') (2004) Saved Policies (2012);
- Kent Minerals and Waste Local Plan (2013-2030) (July 2016);
- Bexley Developers Guide: A Simplified Guide to Planning Applications and Land Contamination (2015); and
- Dartford Contaminated Land Strategy (2008).

#### **Guidance and Standards**

13.2.14 The assessment is underpinned by the following guidance and best practice:

- Contaminated Land Report 11 (CLR 11) 'Model Procedures for the Management of Land Contamination' (DEFRA/EA, 2004);
- BS 5930:2015 "Code of practice for ground investigations" (BSI, 2015); and
- BS 10175:2011+A2:2017 "Investigation of potentially contaminated sites – code of practice" (BSI, 2011).

13.2.15 This assessment adopts a tiered approach to GCA as set out in the aforementioned documents. The assessment also considers the requirements detailed in the Environment Agency's (EA) 'Guiding principles for land

contamination’ (EA, 2010). The guiding principles comprises three documents (Guiding Principles for Land Contamination (GPLC) 1 to GPLC3) that replaced the EAs ‘requirements for land contamination reports’ published in 2005. It should be noted that the GPLC documents were withdrawn at the end of 2015 as part of the measures implemented by the EA as they no longer provide guidance. Whilst regulatory endorsement is no longer in place, these documents still provide useful guidance.

### 13.3 Consultation

13.3.1 **Table 13.2** below summarises the key consultation responses received to date in relation to ground conditions and how they have been responded to during the EIA process.

Table 13.2: Summary of Key Consultation and Responses Relating to Ground Conditions

Reference	Comment	Response
<b>SoS Scoping Opinion</b>		
Section 4.10 – ID 1	In relation to the Electrical Connection route the Inspectorate is content that the works are unlikely to result in significant effects and therefore this matter is scoped out of the ES.	The assessment of the Electrical Connection route (where it is proposed within the public highway) is scoped out of this assessment, see Section 13.5 for further details.  An assessment of the Electrical Connection route (where it falls outside of the public highway) is included within the EIA, and reported in this ES.
Section 4.10 – ID 2	All proposed mitigation and/or necessary remediation should be described within the ES.	A Tier 2 risk assessment is provided within the Phase 2 GCA ( <b>Appendix I.2</b> ), which provides recommendations for further work and preliminary recommendations in relation to mitigation/remediation as appropriate. This information has been used within this Chapter.



Reference	Comment	Response
Section 4.10 – ID 3	The method for assessing the significance of potential effects has not been identified within the Scoping Report. This should be included within the ES.	The method for assessing the significance of potential effects is described in Section 13.5 below.
Section 4.10 ID – 4	The Inspectorate has stated that the potential for effects on Abbey Wood SSSI should be assessed within the ES.	<p>The potential effects on relevant sensitive receptors have been included in the baseline assessments (<b>Appendix I.1 and I.2</b>) accompanying the ES.</p> <p>Potential effects on Abbey Wood SSSI are considered in <b>Chapter 11</b> of the ES.</p>
Section 4.10 – ID 5	The Inspectorate has stated that the study area for ground conditions should be described and justified within the ES.	The study area for this assessment is defined and justified in Section 13.5 below.
<b>S42 Consultation Responses</b>		
<b>London Borough of Bexley</b>	<p>It is understood that a preliminary site investigation is being undertaken to provide further information to inform the on-going assessment of the likely effects on ground conditions and there is a need for further intrusive investigation to further refine the preliminary conceptual site model, the details and findings of which should be presented within the final report along with any remediation that may be required.</p> <p>It is understood that the Environment Agency have been consulted separately on the PEIR and their comments will be crucial to the development of these proposals to ensure that ground water is not negatively impacted.</p>	<p>Noted, the findings of the preliminary ground investigation and an Outline Remedial Strategy are presented in a Phase 2 Ground Condition Assessment (<b>Appendix I.2</b> to this ES).</p> <p>Comments from the Environment Agency on Chapter 13 of the PEIR are outlined below in this table. Further comments from the EA are outlined in Chapter 12.</p>

Reference	Comment	Response
<b>Environment Agency</b>	We have reviewed Chapter 13 Ground Conditions and accept that site assessment and investigation will be undertaken in accordance with CLR11.	Noted.

### 13.4 Reasonable Worst Case Parameters Used for Assessment

13.4.1 In respect of ground conditions, the range of parameters for the Proposed Development outlined in **Chapter 3** have no bearing on potential significant effects. However, in undertaking the ground conditions assessment, a number of reasonable worst-case scenarios are considered for the Proposed Development. These include:

- An appraisal of the variation in ground conditions pertaining to the REP site, Main Temporary Construction Compound, Data Centre site, and Electrical Connection route areas outside of the existing highway including the effects of anthropogenic activities that have already occurred at the site;
- Variability of groundwater conditions pertaining to the REP site including, where appropriate, consideration of both tidal and seasonal effects; and
- The potential for yet undiscovered contamination to be present on the REP site and Main Temporary Construction Compound.

### 13.5 Assessment Methodology and Significance Criteria

#### Study Area

13.5.1 The study area is defined as the REP site and up to 1 kilometre (km) radius from it, as based on professional judgement, this is considered to represent the likely maximum zone of influence of any potential significant impacts from contamination. The study area also includes the Main Temporary Construction Compound, the Data Centre site, and the areas of the Electrical Connection route options outside of the existing highways that would be located within the Application Boundary. Where impacts have the potential for effects further afield, (e.g. pollutant pathways such as streams/rivers) this has been identified.

13.5.2 The study area does not include the Electrical Connection route areas that are located within existing highways, as these areas have previously been scoped out of the ES as agreed through the Scoping Opinion (see Table 13.2). The likely limited excavation depth is consistent for each route option. The depth for the electrical connection trench is c. 1.2 m except where there is potential for trenchless installation techniques to be required, or localised deeper trench, to be required to overcome a specific constraint. Where the Electrical Connection route is outside of existing highways, and there is likely to be ground disturbance, these areas are included in this assessment as part of the study area.

13.5.3 The Application Boundary includes an area within the River Thames. However, as there are no (intrusive or non-intrusive) works proposed within this area there is no potential for significant effects in relation to ground conditions. The area has therefore been scoped out of this assessment in relation to ground conditions.

### Baseline Data Collection

13.5.4 The assessment of ground conditions at the REP site has been undertaken following a tiered approach as recommended within industry guidance (namely the Model Procedures for the Management of Contaminated Land (CLR11)) as outlined below:

- Tier 1 – Preliminary risk assessment: a qualitative assessment of historical and published information, together with a site reconnaissance, undertaken in order to develop a preliminary conceptual site model and inform a preliminary risk assessment;
- Tier 2 – Generic quantitative risk assessment: an assessment of ground condition data using published generic assessment criteria to screen the site and establish whether there are actual, or potential, unacceptable risks; and (if required)
- Tier 3 – Detailed quantitative risk assessment: involving the generation of site specific assessment criteria (SSAC).

13.5.5 The methodology adopted in this Chapter is progressive from a Tier 1 qualitative assessment of generic factual information with the assessed risks informed by professional judgement to Tier 2 quantitative assessment using site specific factual data from intrusive investigations with the assessed risks stated with reasonable certainty. The requirement for a Tier 3 assessment has not been identified following the completion of the preliminary Tier 2 assessment due to the requirement for further Tier 2 assessment.

13.5.6 It is also recognised that certain soils can be a cause of land instability, either as a result of natural processes or as a result of historical activities such as excavation, resulting in landslides or slips, soil creep, and ground compression. Where there are reasons for suspecting instability, appropriate assessment including site investigations and geotechnical appraisal is undertaken to determine whether:

- The land is capable of supporting the loads proposed to be imposed;
- The development will be threatened by unstable slopes on or adjacent to the REP site;
- The development will initiate slope instability which may threaten its neighbours;

- The REP site could be affected by ground movements due to natural cavities; or
- The REP site could be affected by ground movements due to past, present or foreseeable future mining or excavation activities.

### Assessment

13.5.7 The assessment has involved a study of available desk-based information (including the results of previous soil sampling for investigations and validation reports relating to previous remediation works undertaken on land within and surrounding the REP site), a review of environmental datasets, and regulatory responses to enquiries, as well as a site walkover survey. In addition, following completion of a preliminary Phase 2 Ground Investigation, reference has also been made to site-specific geoenvironmental laboratory testing of soil and water samples from the REP site, ground gas concentration and groundwater level monitoring.

13.5.8 In order to evaluate whether the presence of a source of contamination could potentially lead to harmful consequences, a source-pathway-receptor methodology has been adopted, with the underlying principle that the identification of pollutant linkages consists of the following three elements:

- A source/hazard (a substance or situation that has the potential to cause harm or pollution);
- A pathway (a means by which the hazard moves along / generates exposure); and
- A receptor/target (an entity that is vulnerable to the potential adverse effects of the hazard).

13.5.9 A source of contamination may be a hazard but does not constitute a risk unless all three elements are present (and therefore a pollutant linkage). Therefore, in assessing the potential for contamination to cause a significant effect, the extent and nature of the potential source or sources of contamination must be assessed, any pathways present must be identified, and sensitive receptors or resources identified and appraised. This will result in the determination of their value and sensitivity to contamination related impacts.

13.5.10 Baseline conditions for REP have been identified and defined using both Phase 1 and Phase 2 GCA of the REP site, which present information on the environmental setting of REP and include Tier 1 qualitative and Tier 2 quantitative assessments (REP site only) respectively, included as **Appendices I.1 and I.2**.

13.5.11 The Phase 1 and Phase 2 GCA describe the type and locations of:

- Potential Sources of Contamination (PSCs) – at Tier 1 this is based on identification of current and historical land use, and refined at Tier 2 using investigation data and identification of where concentrations of PSCs exceed chosen threshold concentrations.
- The type and sensitivity of potential receptors (including consideration of human health, property (buildings), property (animal and crop), groundwater, surface water and ecological systems and identification of possible migration or transportation pathways.
- Potential Geological Hazards (PGHs) – the Tier 1 assessment identifies ground stability hazards that may result from artificial or natural cavities, and foundation conditions that may be affected by compressibility, shrinkage/swelling of clay stratum and groundwater and slope instability.

13.5.12 The Tier 2 preliminary risk assessment has been informed through a ground investigation carried out at the REP site by the Applicant, as described in **Appendix I.2**. The primary purpose of the ground investigation was to provide geotechnical design information for the detailed design of the structures proposed as part of the development, however the scope of works was extended to also include geoenvironmental sampling and laboratory testing, and installation of additional groundwater and ground gas monitoring wells in boreholes. The ground investigation was carried out by Terraconsult Ltd between March and May 2018 and comprised a combination of cable percussion and rotary drilled boreholes, and including geoenvironmental monitoring and sampling of soil and water.

### Significance Criteria

13.5.13 **Tables 13.3** and **13.4** illustrate how the value of the receptor and the magnitude of the impact are determined, leading to evaluation of the significance of effect which can be negligible, minor, moderate, major or substantial.

13.5.14 The classifications have been generated using descriptions of environmental receptor importance and value given in various guidance documents including Guidance for the Safe Development of Housing on Land Affected by Contamination (National House Building Council (NHBC) 2008) and Department of the Environment, Transport and the Regions (DETR) Circular 02/2000, Contaminated Land: Implementation of Part 2A of the Environmental Protection Act 1990. Human health and buildings classifications have been generated by PBA based on professional judgement.

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Table 13.3 Criteria Used in Ground Conditions for Classifying Receptor Value or Sensitivity

Classification	Definition
<p>High Receptor of national or international importance</p>	<p>Human health: Residential and uses where children are present</p> <p>Groundwater: Source Protection Zone</p> <p>Surface water: General Quality Assessment (GQA) Grade A or B High Ecological Status</p> <p>Ecology: Special Areas of Conservation (SAC) and candidates, Special Protection Areas (SPA) and potentials or wetlands of international importance (RAMSAR)</p> <p>Buildings: World Heritage Site or Conservation Area</p>
<p>Medium Receptor of county or regional importance</p>	<p>Human health: Employment</p> <p>Groundwater: Principal aquifer &amp; Secondary A aquifer</p> <p>Surface water: GQA Grade C or D Good or Moderate Ecological Status</p> <p>Ecology: SSSI, National or Marine Nature Reserve (NNR or MNR) County Wildlife Sites (CWS)</p> <p>Buildings: Area of Historic Character</p>
<p>Low Receptor of local importance</p>	<p>Human health: Transient or Limited Access. Unoccupied/Industrial land use and construction workers*</p> <p>Groundwater: Secondary B aquifer or Unproductive</p> <p>Surface water: Poor Ecological Status</p> <p>Ecology: Local habitat resources or no designation</p> <p>Buildings: Replaceable/Local value</p>

\* assuming that construction workers will adopt appropriate health and safety and personal protective equipment procedures to be secured through an outline Code of Construction Practice (CoCP) and to be submitted as part of the REP Development Consent Order (DCO).

Table 13.4: Magnitude of Impact in Relation to Ground Conditions

Magnitude	Example	
Large	Adverse	A marked impact that causes a key attribute of the receptor to be lost/degraded.
	Beneficial	A marked improvement in relation to a key attribute of the receptor.
Moderate	Adverse	A noticeable impact that exceeds a standard (for example a Soil Guidance Value (SGV)) but that does not cause a key attribute of the receptor to be lost/degraded.
	Beneficial	Benefit to, or addition of, key characteristics, features, or elements or improvement of attribute quality.
Small	Adverse	A discernible impact that is below a standard (for example a SGV) and does not cause a key attribute of the receptor to be lost/degraded.
	Beneficial	A discernible improvement in relation to a key attribute of the receptor.
Negligible/no effect	No discernible impact (either adverse or beneficial) on the receptor.	

13.5.15 The matrix for assigning the significance of effects is presented as **Table 13.5**. Effects of ‘moderate’ significance or above are considered significant in EIA terms.

Table 13.5: Significance of Effects for Assessing Ground Conditions

Sensitivity/ Value of Receptor	Magnitude of Impact			
	Large	Moderate	Small	Negligible
High	Substantial	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible/ no effect
Low	Moderate	Minor	Negligible/ no effect	Negligible/ no effect

### 13.6 Assumptions and Limitations

- 13.6.1 Some of the conclusions in this assessment and the Phase 1 GCA are based on third party data. Where remediation validation reports are not available, as described in **Appendix I.1**, assumptions have been made regarding the extent of such work based on the agreed remedial strategies.
- 13.6.2 This assessment is in part based on published information which is generic to the wider area rather than specific to the REP site, Main Temporary Construction Compound, Data Centre site and where ground disturbance is proposed along the Electrical Connection route and outside of existing highways. Where this is the case, professional judgement has been used to inform the assessment in terms of likelihood and degree of contamination associated with the identified land uses.
- 13.6.3 Historical maps and aerial photographs used as part of the studies provide a 'snap shot' in time about conditions or activities at the REP site, Main Temporary Construction Compound and Data Centre site, and as such cannot be relied upon as indicators of any events or activities that may have taken place at other times.
- 13.6.4 It should also be noted that groundwater levels, groundwater chemistry, surface water levels, surface water chemistry, soil gas concentrations and soil gas flow rates can vary due to seasonal, climatic, tidal and man-made effects.
- 13.6.5 The findings and interpretation of supplementary intrusive works and assessment required to support the discharge of DCO requirements (e.g. Remediation Strategy) will be incorporated into the final Code of Construction Practice (CoCP) to ensure that an appropriate level of mitigation is provided. Risk assessments to further characterise ground conditions and ground gas risks will be updated following additional investigation works and monitoring.



13.6.6 It is assumed that cut and fill earthworks material management, to enable construction of the REP site or importation of materials onto the REP site or Main Temporary Construction Compound during the construction phase (e.g. to obtain required ground elevations or provide a working platform), will be undertaken under a Materials Management Plan (MMP). They would also be subject to appropriate chemical and geotechnical testing and will therefore not present a risk to controlled waters or human receptors. Criteria setting appropriate standards of material quality in relation to geochemical and geotechnical parameters will be established in appropriate works specifications.

13.6.7 The general limitations to the nature of the Phase 2 investigation are outlined in **Appendix I.2**.

13.6.8 It is assumed that ground stability risks will be addressed by the Principal Contractor as part of the design of new buildings and structures located on the REP site in accordance with the respective design codes and controls such as appropriate British Standards and Building Control. Therefore, potential effects associated with buildings and ground instability are not considered as part of the Proposed Development during the Construction or Operational phases.

## **13.7 Baseline Conditions and Receptors**

### **REP site**

#### **Site History**

13.7.1 In summary, the most important previous uses of the REP site and immediately adjacent land to consider from a ground conditions perspective include a Manure Works, a Fish Guano Works and a Borax Refinery. Section 3 of **Appendix I.1** provides further information.

13.7.2 A number of historical ground investigation and remediation reports were prepared for the development of the existing Riverside Resource Recovery Facility (RRRF) that, partly or entirely, cover the REP site. The reports (see **Appendix I.1**) indicate that some remediation has previously taken place in some parts of the REP site.

#### **Current Land Use**

13.7.3 The REP site is open in character save for small scale ancillary structures and buildings associated with the existing RRRF and includes wetland and wasteland habitat areas, container storage areas and hardstanding car parking areas. The existing RRRF falls outside of the Application Boundary, but is encompassed by the REP site.

#### **Geology and Ground Conditions**

13.7.4 A description of the anticipated geological sequence of the REP site is presented in **Appendix I.1** and summarised here.

13.7.5 The published geology and previous ground investigations indicate the sequence to comprise Alluvium over River Terrace Deposits and London Clay with Made Ground also likely to be present.

13.7.6 The recent (Terraconsult, 2018) ground investigations (GI) generally confirms the anticipated geology and indicates the presence of Made Ground up to 5.95 m thick in localised areas (typically <1 m thick). The Made Ground was generally described as a soft to firm black mottled dark brownish grey slightly sandy slightly gravelly to cobbly clay where the gravel/cobbles typically comprised brick, concrete and flint. Less commonly the Made Ground contained glass, metal, wire, plastic, textiles, string, ash, ceramic pieces, asphalt, 'slag', cables and rubber ducting.

### Hydrogeology & Groundwater Vulnerability

13.7.7 In relation to hydrogeology and groundwater vulnerability, the Alluvium is considered to be a Secondary Undifferentiated aquifer and the River Terrace Deposits are considered to be a Secondary A aquifer. The London Clay is considered to be Unproductive Strata.

13.7.8 The REP site is not located within any part of a Groundwater Source Protection Zone (SPZ).

13.7.9 The Phase 2 GCA indicates that shallow groundwater is present within the Alluvium, typically within 1 m of the ground surface. In addition, groundwater was also encountered within the River Terrace Deposits as sub artesian and it is likely that the groundwater in this deposit is also tidally influenced. Further groundwater strikes were encountered in the Harwich Formation beneath the London Clay and this aquifer also indicated sub artesian conditions.

13.7.10 It is considered likely that there is vertical continuity between any groundwater in the Made Ground and in the underlying Alluvium, and that there is horizontal continuity between groundwater in the Made Ground, Alluvium and River Terrace Deposits, with the tidal River Thames.

### Geoenvironmental Conditions – Soils

13.7.11 The Phase 2 GCA has identified that during the 2018 Terraconsult GI, asbestos was positively identified and quantified within Made Ground materials across the REP site, but largely clustered within the current Wasteland Habitat Area (a non-operational part of the site reserved for existing on site biodiversity mitigation provision). The presence of asbestos was identified in 12 out of 28 samples tested. It is considered that there is a **High** potential for contamination hazard associated with asbestos in the Made Ground at the REP site.

13.7.12 Previous validation reports indicate that a remediation target criteria of 500 mg/kg was adopted for Total Petroleum Hydrocarbon (TPH) concentrations during the development of the RRRF (and including areas that comprise the REP site), and that in some cases this threshold was not met by the validation testing. However, the assessment in the reports (described in **Appendix I.2**)

concluded that these exceedances did not pose a significant risk to human health on the basis that a clean capping layer was proposed.

- 13.7.13 As part of the 2018 Terraconsult GI, 27 samples of soils were submitted to a laboratory for a range of hydrocarbon testing suites. The Tier 2 risk assessment has not identified any exceedances of the respective adopted assessment criteria for human health in an industrial/commercial end use scenario and therefore has not identified hydrocarbons as a potential hazard to human health in the context of the Proposed Development. It is considered that there is a **Low** potential for contamination hazard associated with hydrocarbons at the REP site.
- 13.7.14 During the 2018 Terraconsult GI, 40 samples of soils were submitted to a laboratory for testing for a range of individual and heavy metals suite testing. The results did not indicate any exceedances of the respective adopted assessment criteria for human health in an industrial/commercial scenario and therefore the Tier 2 risk assessment has not identified metals/heavy metals in soils as a human health hazard in the context of the Proposed Development. It is considered that there is a **Low** potential for contamination hazard associated with metals/heavy metals at the REP site.
- 13.7.15 The Phase 2 GCA has identified the presence of natural sources of ground gas at the REP site, and site specific monitoring indicates the presence of hazardous ground gas concentrations. The preliminary ground gas risk assessment indicates that with the data available, and in accordance with the hazard classification system outlined in Table 2 of BS8485:2015, the REP site would be classified as Characteristic Situation 3 (CS3 - GSV range from 0.7 l/hr to <3.5 l/hr). It is therefore considered that there is a **Moderate** hazard potential in relation to naturally occurring hazardous ground gases at the REP site from underlying peat.

### **Geoenvironmental Conditions – Controlled Waters**

- 13.7.16 The Phase 2 GCA indicates that 22 samples of groundwater and surface water from the REP site (including upstream and downstream River Thames) were submitted to the laboratory for a range of hydrocarbon testing suites, together with metals/ heavy metals testing. The results generally indicate concentrations below the laboratory limit of detection for each test parameter with limited localised exceptions. It is considered that there is **Low** potential for a significant widespread contamination hazard associated with controlled waters at the REP site.
- 13.7.17 The Tier 2 risk assessment indicates that concentrations of vapour generating potential contaminants have not been recorded above the adopted screening criteria. It is therefore considered that there is a **Low** potential for a significant widespread vapour hazard associated with controlled waters at the REP site.

## Summary of Potential Receptors

13.7.18 Potential Receptors identified for the REP site are set out in **Table 13.6** below:

Table 13.6: Potential Receptors - the REP site

Item	Comment
Human Health – Current	Current workers/visitors
Human Health – Future	Workers/visitors
Human Health – Off-site*	Workers at the RRRF, the adjacent industrial park, users of Thames Path
Human Health – Construction	Construction workers
Groundwater (shallow)	Secondary A aquifers present
Surface Water	River Thames and surface drainage ditches/dykes
Property - Buildings	REP would be considered as a receptor on the basis that the Proposed Development is granted Development Consent
Property - Animal or Crop Effect	Horses are grazed adjacent to this site area
Ecological Systems	On-site wetland and wasteland habitat areas Crossness Local Nature Reserve is located adjacent to this site area

\*Off-site human health is not considered to be a receptor for the sources of natural ground gas identified, as the source is present in the wider area and is not limited to the REP site.

## Main Temporary Construction Compound & Data Centre site

### Site History

13.7.19 The Data Centre site was developed initially for residential use around the turn of the 20<sup>th</sup> Century. Subsequently this area was used for the storage of 'waste' from a Borax refinery to the north of this area, until this material was removed in the late 1980's/early 1990's.

13.7.20 The historical maps indicate that the Main Temporary Construction Compound area was undeveloped until the mid-1950s when a large electrical sub-station was developed. This substation, owned by National Grid, was operated until its closure in 2005 and subsequent demolition in 2010/2011.

### Current Land Use

13.7.21 The Data Centre site is currently unused and is consented for development as a Data Centre (15/02926/OUTM).

13.7.22 In the Main Temporary Construction Compound area, a warehouse/industrial unit is present with an associated concrete service yard. There are unused areas of land either side of the warehouse building. Land to the north of the warehouse building has planning consent for a two-storey office block and use Class B1 workshop (LPA Reference 12/01930/FUL), while land to its south has planning consent for the erection of a foul water pumping station, electricity substation and meter house (LPA Reference 16/00986/FUL).

### **Geology and Ground Conditions**

13.7.23 The published geology (see Section 4.1.1 of **Appendix I.1**) indicates that the anticipated sequence of strata at both the Main Temporary Construction Compound and the Data Centre site is likely to be Alluvium over River Terrace Deposits and London Clay or the Lambeth Group if the London Clay is absent. However, a review of historical ground investigation reports indicates that a variable thickness of Made Ground is likely to overlie the natural strata across the area, due to previous development.

### **Hydrogeology and Groundwater Vulnerability**

13.7.24 In relation to hydrogeology and groundwater vulnerability, the Alluvium is considered to be a Secondary Undifferentiated aquifer and both the River Terrace Deposits and the Lambeth Group are considered to be Secondary A aquifers. The London Clay is considered to be Unproductive Strata.

13.7.25 The Main Temporary Construction Compound and the Data Centre site are not located within any part of a Groundwater Source Protection Zone (SPZ).

### **Geoenvironmental Conditions – Soils, Groundwater and Surface Water**

13.7.26 A site specific ground investigation was limited to the REP site within the Application Boundary as part of this EIA (see **Appendix I.2** for further information). **Appendix I.1** has identified the potential for natural sources of hazardous ground gases within the area proposed for the Main Temporary Construction Compound, and has recommended that appropriate intrusive works and Tier 2 risk assessment would need to be undertaken. It is considered that there is a **High** potential for a naturally occurring ground gas hazard to exist in the area proposed for the Main Temporary Construction Compound (see **Appendix I.1** for further information). The Data Centre site is consented for development, however, the Phase 1 GCA has identified the potential presence of asbestos in previously imported fill used to infill areas of excavated contaminated materials, and potential natural ground gas sources. It is considered that there is a **High** potential for a significant contamination hazard associated with asbestos to be present in this area, and a **High** potential associated with hazardous ground gases.

### Summary of Potential Receptors

13.7.27 Potential Receptors identified for the Main Temporary Construction Compound are set out in **Table 13.7** below:

Table 13.7: Potential Receptors – Main Temporary Construction Compound

Item	Comment
Human Health – Current	Users of warehouse/office building
Human Health – Off-site	Users of adjacent nature reserve*
Human Health – Construction	Construction Workers
Groundwater (shallow)	Secondary A Aquifer Present
Surface Water	Surface drainage ditches/dykes
Property - Buildings	Existing industrial type building, no new structures proposed – area for construction lay-down
Property - Animal or Crop Effect	Horses are grazed adjacent to this site area
Ecological Systems	Crossness Local Nature Reserve is located adjacent to this site area

\*Off-site human health is not considered to be a receptor for the sources of natural ground gas identified, as the source is present in the wider area and is not limited to this area.

13.7.28 Potential Receptors identified for the Data Centre site are set out in **Table 13.8** below:

Table 13.8: Potential Receptors – Data Centre site

Item	Comment
Human Health – Off-site*	Users of adjacent nature reserve
Human Health – Construction	Construction Workers
Groundwater (shallow)	Secondary A Aquifer Present
Surface Water	Surface drainage ditches/dykes
Property - Animal or Crop Effect	Horses are grazed adjacent to this site area
Ecological Systems	Crossness Local Nature Reserve is located adjacent to this site area

\*Off-site human health is not considered to be a receptor for the sources of natural ground gas identified, as the source is present in the wider area and is not limited to this area.

### **Electrical Connection route (Areas outside of existing highways)**

13.7.29 The areas of the Electrical Connection route that are located outside of existing highways where ground disturbance is proposed (and therefore not scoped out of the assessment) as described in **Appendix I.1** and summarised here are:

- Southern end of Norman Road – proposed cable support structure or use of trenchless installation techniques beneath the water channel (route option 1A)
- The A206 between the roundabout with Crayford Way and the roundabout with Bob Dunn Way – here trenchless installation techniques are proposed beneath the River Cray (route option 1/1A)
- The A206 (Thames Road) to the west of the Bob Dunn Way roundabout, beneath the railway bridge – here trenchless installation techniques are proposed beneath the highway (route option 1/1A)
- The A206 (Bob Dunn Way) at the crossing of the River Darent - here it is proposed to attach the cable to the existing above ground infrastructure over the river (route option 1/1A)

### **Site History**

13.7.30 The site history of the areas identified includes undeveloped open/marsh land (southern end of Norman Road and A206 between Crayford Way and Bob Dunn Way), and a historical inert landfill (south of Bob Dunn Way at the crossing of the River Darent).

### **Current Land Use**

13.7.31 The Phase 1 GCA has identified that all of the areas identified are currently open undeveloped land.

### **Geology and Ground Conditions**

13.7.32 The published geology (see Section 4.1.1 of **Appendix I.1**) indicates that the anticipated sequence of strata in the areas identified is likely to be Alluvium overlying River Terrace Gravels and the London Clay and Lambeth Group. However, in the area of the historical landfill there is likely to be inert waste materials partially replacing some of the natural strata.

### **Hydrogeology and Groundwater Vulnerability**

13.7.33 In relation to hydrogeology and groundwater vulnerability, the Alluvium is considered to be a Secondary Undifferentiated aquifer and both the River Terrace Deposits and the Lambeth Group are considered to be Secondary A aquifers. The London Clay is considered to be Unproductive Strata.

13.7.34 The Electrical Connection route passes predominantly through Zones 2 and 3 of groundwater source protection zones (SPZ) along the route, but in the area to the south of Bob Dunn Way where the route crosses the River Darent the route passes through an SPZ 1.

### Geoenvironmental Conditions – Soils, Groundwater and Surface Water

13.7.35 Site specific ground investigation has not been undertaken in the Electrical Connection route areas as part of this EIA. **Appendix I.1** has identified the potential for natural sources of hazardous ground gases and where historical landfill is present, for contamination and landfill gases.

13.7.36 It is considered that there is a **Low to High** potential for a significant contamination hazard (associated with landfill material where high) to be present in this area, and a **High** potential associated with hazardous ground gases.

### Summary of Potential Receptors

13.7.37 Potential Receptors identified for the Electrical Connection route areas are set out in **Table 13.9** below:

Table 13.9: Potential Receptors – Electrical Connection route Area

Item	Comment
Human Health – Construction	Construction Workers
Groundwater (shallow)	Secondary A Aquifer Present
Surface Water	River Cray and Darent

### Baseline Evolution

13.7.38 In the absence of the Proposed Development, and if land uses at the REP site, Main Temporary Construction Compound, Data Centre site and Electrical Connection route areas remain as they currently are, it is considered that the ground conditions would remain unchanged from the current baseline. In the event that the developments consented in the Main Temporary Construction Compound and Data Centre site are built out, there is likely to be a beneficial change to the baseline conditions in these areas.

13.7.39 Although changes in legislation or guidance (such that acceptable levels of potential hazards are reduced), or in surrounding land-use (that generates contamination) or the introduction of receptors (such as a new groundwater abstraction well) could alter the baseline conditions it is considered that these scenarios cannot be assessed and are not therefore considered further.

13.7.40 **Appendix A.4** provides a full list of ‘other development’ which have been identified as being likely to be constructed prior to the construction of the Proposed Development. Where relevant, these schemes therefore form part of the ‘future baseline’ scenario and have been taken account of in the assessment



of likely significant impacts from the Proposed Development (construction and operation) presented in **Section 13.9**.

13.7.41 It is considered that the 'other development' will be built out having gone through the planning regime which will secure remediation as appropriate. It is therefore considered that there will be no adverse changes to the ground conditions, and that any changes to ground conditions would be beneficial.

### **13.8 Embedded Mitigation**

13.8.1 It is recognised that the Proposed Development would provide embedded mitigation measures including an outline CoCP (**Document Reference 7.5**) to be submitted as part of the REP DCO that will include requirements for working within best practice guidelines, preventing the release of contamination and therefore negating any effects from such releases / construction activities on the environment.

13.8.2 It is also recognised that the construction required to enable the REP facility design i.e. via construction of its foundations and below ground structures may result in the removal of ground that may be contaminated, hence resulting in the removal of the contamination source. Off-site disposal of arisings would be undertaken in accordance with the Waste Duty of Care Code of Practice (March 2016), and the excavation and re-use of materials would be undertaken in accordance with a Materials Management Plan (MMP) included as part of the final CoCP.

13.8.3 Furthermore, construction methods such as appropriate piling techniques to minimise the risk of mixing of aquifer bodies through the creation of new pathways would form part of the embedded mitigation. This includes the provision of a Foundation Works Risk Assessment (FWRA) which would be undertaken by the contractor once the proposed foundation solutions are known, and the use of EA guidance 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination' (EA, 2001). A requirement to carry out such an assessment is included within the outline CoCP (**Document Reference 7.5**), submitted as part of the REP DCO. Embedded mitigation will be incorporated into the outline CoCP to reduce exposure to construction dust and vapour/ground gases.

13.8.4 In relation to the potential for exposure of current users/construction workers to ground gas, the CoCP will include protocols for working in confined spaces, in accordance with HSE Approved Code of Practice 'Safe work in confined spaces'. Where required, temporary confined spaces/construction buildings (e.g. cabins) would include void space below them to allow for passive ventilation.

13.8.5 The CoCP would include details of the protocol to be followed in the event of previously undiscovered contamination being encountered during enabling works and/or construction.

13.8.6 Material moved around the REP site or imported onto the REP site or Main Temporary Construction Compound during the construction phase (e.g. to obtain required ground elevations or provide a working platform) will be undertaken in accordance with a MMP.

13.8.7 During the operational phases of development, REP would be managed in accordance with the Applicant's existing Environmental Management System, which includes such measures as spill response procedures and requirements for the correct handling of any hazardous substances.

13.8.8 Where the Electrical Connection route crosses the River Darent to the south of Bob Dunn Way, the proposed option for trenchless installation techniques avoids any excavation or ground disturbance within the area of the former historical landfill and this commitment will be included within the CoCP.

13.8.9 The operation of the Proposed Development would be governed by the requirements of an Environmental Permit.

### 13.9 Assessment of Likely Effects

#### The REP Site, Main Temporary Construction Compound and Data Centre site

##### Construction/Decommissioning

13.9.1 It is assumed for the purposes of this assessment that the REP would be removed once the plant had ceased operations permanently. Any decommissioning phase is assumed to be of a similar or shorter duration to construction, and therefore environmental effects are considered to be of a similar level to those during the construction phase. It is assumed that the ducting for the Electrical Connection would remain in situ, but that the cables may be removed.

13.9.2 It is noted that the assessment presented below relates to the construction period of the Proposed Development only and is not an assessment of the risks to current RRRF staff prior to construction commencing.

13.9.3 The Tier 2 risk assessment has identified the presence of asbestos within the Made Ground, together with potentially elevated hazardous ground gas concentrations at the REP site.

13.9.4 The presence of asbestos within the Made Ground at the REP site has the potential to affect current users, construction workers and off-site human health through the respiration of airborne fibres during any excavations and ground disturbance during construction. The potential impacts in relation to human health are anticipated to result in a **Moderate** effect for construction workers and **Major** effect for current users during construction and **Negligible/no effects** for off-site human health.

- 13.9.5 It is considered that subject to implementation of the embedded mitigation described in Section 13.8, the potential impacts on remaining receptors identified for the REP site in relation to asbestos are anticipated to result in **Negligible/no effect**.
- 13.9.6 The Tier 2 preliminary ground gas risk assessment has identified the REP site as Characteristic Situation 3 in accordance with BS8485:2015, and therefore the potential impacts are anticipated to result in a **Major** effect in relation to human health (current users) and **Negligible/no effect** (construction workers) and a **Moderate** effect in relation to buildings.
- 13.9.7 The Tier 1 qualitative risk assessment identified a potential natural ground gas source in the strata at the Main Temporary Construction Compound and the Data Centre site, and subject to implementation of the embedded mitigation, the potential impact is anticipated to result in a **Negligible/no effect** in relation to human health (construction workers) and a **Negligible/no effect** in relation to temporary construction buildings. It is assumed that as the development of the existing warehouse/office building at the Main Temporary Construction Compound was subject to assessment through the planning regime, the building protects current users in relation to ground gas and therefore the potential impacts on current users in relation to ground gas are anticipated to result in **Negligible/no effects**. The potential impacts are anticipated to result in **Negligible/no effects** for all remaining receptors.
- 13.9.8 A High potential for contamination hazard has been identified in the Data Centre site, in relation to the potential for asbestos within the Made Ground material. The potential impact in this area is anticipated to result in a **Moderate/Substantial** effect for human health and **Negligible/no effects** for all remaining receptors.
- 13.9.9 Potential contamination within the soils and groundwater has the potential to affect construction workers. Historical ground investigations have shown potential for residual contamination to be present, and including the potential for as yet undiscovered potential sources of contamination, which may cause health impacts as a result of direct or indirect contact with contaminated materials. It is anticipated that, subject to implementation of the embedded mitigation described in Section 13.8 in relation to previously undiscovered contamination, the potential impacts are anticipated to result in **Negligible/no effects**.
- 13.9.10 Pollution releases during construction/decommissioning works have the potential to affect construction workers, groundwater and surface water. During construction works there is potential to introduce new sources of contamination into the environment (for instance, uncontrolled leaks and spills from machinery). To mitigate this potential, no additional measures are required over and above the embedded mitigation referred to in Section 13.8 and that would be included in the outline CoCP (**Document Reference 7.5**) and MMP which will be submitted as part of the REP DCO. With the implementation of the

embedded mitigation measures, the impacts are anticipated to result in **Negligible/no effects**.

13.9.11 A potential effect of the construction/decommissioning of the REP site would be the mixing of aquifer bodies (groundwater) through the creation of new pathways. The anticipated construction of piled foundations from REP extending through the alluvial deposits into the underlying aquifers (maximum depth of piling would be c. -29 m AOD) has the potential to introduce new pathways between aquifer bodies. However, no special mitigation measures are considered necessary over and above the embedded mitigation referred to earlier in this Chapter. This includes the provision of a FWRA which will be undertaken by the contractor once the proposed foundation solutions are known, in accordance with EA guidance 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination' (EA, 2001), and a requirement to carry out such an assessment will be incorporated into the CoCP which will be submitted with the REP DCO. With the implementation of embedded mitigation measures the impacts are anticipated to result in **Negligible/no effects**.

13.9.12 There is the potential for surface waters to be affected by potentially contaminated run off during the construction and decommissioning of REP and Main Temporary Construction Compound. With the implementation of the embedded mitigation measures, the impacts are anticipated to result in **Minor effects**.

13.9.13 There is low potential for groundwater at the Main Temporary Construction Compound and the Data Centre site to be affected by potential contamination due to the proposals for these areas excluding significant excavations. With the implementation of the embedded mitigation measures, the impacts are anticipated to result in **Negligible/no effects**.

13.9.14 With the implementation of the embedded mitigation measures, impacts to low sensitivity receptors such as property (animals/crops) are anticipated to result in **Negligible/no effects**. Similarly, impacts to medium sensitivity receptors such as ecological systems are anticipated to result in **Negligible/no effects**.

### **Operation/Maintenance**

13.9.15 The operation of REP itself is not anticipated to give rise to significant effects to the environment (human health, groundwater, surface water, property, ecological systems) on the basis that it operates in accordance with the Applicant's existing Environmental Management Systems/new Environmental Permit.

13.9.16 There is the potential for future site users/maintenance workers to be affected by exposure to asbestos where Made Ground material is to remain in place in any proposed soft landscaped areas. The potential impact is anticipated to result in a **Major** effect for future users and **Moderate** effect for maintenance workers.

- 13.9.17 Based on the Tier 2 preliminary ground gas risk assessment, future users could be exposed to hazardous ground gases within any buildings or confined spaces and therefore the potential impacts are anticipated to result in a **Major** effect. The impact of ground gas on the proposed buildings is anticipated to result in a **Moderate** effect.
- 13.9.18 During the operational phase of REP, the Main Temporary Construction Compound and the Data Centre site will not be in use as part of the Proposed Development, and therefore these areas have not been considered further in this part of the assessment.

### **The Electrical Connection and the Cable Route Temporary Construction Compounds**

#### **Construction/Decommissioning**

- 13.9.19 The Tier 1 quantitative risk assessment has identified that construction workers could be exposed to hazardous ground gases (in confined spaces) from natural sources in all of the areas identified and/or anthropogenic sources in the area of historical landfill. However, subject to implementation of the embedded mitigation, the potential impact is anticipated to result in **Negligible/no effects** in relation to human health.
- 13.9.20 Construction workers could be exposed to landfill materials during any excavations and ground disturbance in the area of historical landfill. With the implementation of embedded mitigation measures the impacts are anticipated to result in **Negligible/no effects**.
- 13.9.21 There is the potential for surface waters to be affected by potentially contaminated run off during construction works for the Electrical Connection route in the area of the historical landfill. With the implementation of the embedded mitigation measures, the impacts are anticipated to result in **Negligible/no effects**.
- 13.9.22 There is the potential for groundwater to be affected during any trenchless installation for the Electrical Connection route in the area of the historical landfill. With the implementation of embedded mitigation measures the impacts are anticipated to result in **Negligible/no effects**.

#### **Operation/Maintenance**

- 13.9.23 The operation of the Electrical Connection route is not anticipated to give rise to significant effects to the environment (human health, groundwater, surface water, property, ecological systems).
- 13.9.24 During the operational phase of REP, the cable route temporary construction compounds will not be in use as part of the Proposed Development, and therefore these areas have not been considered further in this part of the assessment.

## Summary of Assessment

### Construction/Decommissioning

13.9.25 On the basis of the adoption and implementation of the embedded mitigation measures described above, the following tables summarise the potential effects of construction and decommissioning at the REP site, Main Temporary Construction Compound, and Data Centre site.

Table 13.10: Summary of assessed Risks related to Construction and Decommissioning phases and assigned potential effects – REP site

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Human Health – Site Users (medium)	Large Adverse	The proposed construction and any ground disturbance work would potentially expose current users to asbestos within the Made Ground.	<b>Major</b> (significant)
		Current users could be affected by potential hazardous ground gases in any buildings or confined spaces.	<b>Major</b> (significant)
Human Health – Off-site (medium)	Negligible/no effect	Mitigation measures will reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)
Human Health – Construction (low)	Large Adverse	Proposed standard mitigation measures may not be sufficient to protect construction workers from the risk of exposure to asbestos.	<b>Moderate/ Substantial</b> (significant)

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
	Negligible/no effect	Construction workers could be affected by potential hazardous ground gases in any buildings or confined spaces. The embedded mitigation reduces the impact and effect.	<b>Negligible/no effect</b> (not significant)
Groundwater (medium)	Negligible/no effect	The Tier 2 risk assessment has not identified any significant widespread contamination in the groundwater at the REP site, or in the soil that could affect the groundwater. The proposed embedded mitigation will include a FWRA to mitigate the potential for creation of new pathways and aquifer mixing.	<b>Negligible/no effect</b> (not significant)
Surface Water (high)	Negligible/no effect	The Tier 2 risk assessment has not identified any significant widespread contamination in the surface water at the REP site, or in the soil that could affect the surface water.	<b>Minor</b> (not significant)

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
		The embedded mitigation includes an outline CoCP ( <b>Document Reference 7.5</b> ) to be submitted as part of the REP Development Consent Order (DCO) application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects.	
Property – Buildings (low)	Large Adverse	Concentrations of potential hazardous ground gases could accumulate in existing and new buildings at the site.	<b>Moderate</b> (significant)
Property – Animal or Crop (low)	Negligible/no effect	Mitigation measures to reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)
Ecological Systems (medium)	Negligible/no effect	Mitigation measures to reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)

Table 13.11: Summary of assessed Risks related to Construction and Decommissioning phases and assigned potential effects – Main Temporary Construction Compound



Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Human Health – Site Users (medium)	Negligible/no effect	Current users should not be affected by potential hazardous ground gases in any buildings or confined spaces.	<b>Negligible/no effect</b> (not significant)
Human Health – Construction (low)	Negligible/no effect	Construction workers could be affected by potential hazardous ground gases in any buildings or confined spaces. The embedded mitigation reduces the impact and effect.	<b>Negligible/no effect</b> (not significant)
Groundwater (medium)	Negligible/no effect	<p>The proposed use is for a temporary lay down area excluding significant excavations.</p> <p>The proposed mitigation measures include an outline CoCP (<b>Document Reference 7.5</b>) and MMP to be submitted as part of the REP Development Consent Order (DCO) application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects.</p>	<b>Negligible/no effect</b> (not significant)
Surface Water (high)	Negligible/no effect	<p>The proposed mitigation measures include an outline CoCP (<b>Document Reference 7.5</b>) and MMP to be submitted as part of the REP Development Consent Order (DCO) application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects.</p>	<b>Minor</b> (not significant)

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Property – Buildings (low)	Negligible/no effect	Concentrations of potential hazardous ground gases could accumulate in temporary construction buildings/confined spaces at the site, however the embedded mitigation reduces the impact and effect. It is assumed the existing building has appropriate ground gas protection measures	<b>Negligible/no effect</b> (not significant)
Property – Animal or Crop (low)	Negligible/no effect	Mitigation measures to reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)
Ecological Systems (medium)	Negligible/no effect	Mitigation measures to reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)

Table 13.12: Summary of assessed Risks related to Construction and Decommissioning phases and assigned potential effects – Data Centre site

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Human Health Construction (low)	Negligible/no effect	Construction workers could be affected by potential hazardous ground gases in any buildings or confined spaces. The embedded mitigation reduces the impact and effect.	<b>Negligible/no effect</b> (not significant)
	Large Adverse	Proposed standard mitigation measures may not be sufficient to protect construction workers	<b>Moderate/Substantial</b> (significant)

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
		from the risk of exposure to asbestos.	
Groundwater (medium)	Negligible/no effect	Significant excavations are not anticipated. The proposed mitigation measures include an outline CoCP ( <b>Document Reference 7.5</b> ) and MMP to be submitted as part of the REP DCO application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects	<b>Negligible/no effect</b> (not significant)
Surface Water (high)	Negligible/no effect	The proposed mitigation measures include an outline CoCP ( <b>Document Reference 7.5</b> ) and MMP to be submitted as part of the REP Development Consent Order (DCO) application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects	<b>Minor</b> (not significant)

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Property – Buildings (low)	Negligible/no effect	Concentrations of potential hazardous ground gases could accumulate in confined spaces/temporary construction buildings at the site, however the embedded mitigation reduces the impact and effect on temporary new buildings.	<b>Negligible/no effect</b> (not significant)
Property – Animal or Crop (low)	Negligible/no effect	Mitigation measures to reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)
Ecological Systems (medium)	Negligible/no effect	Mitigation measures to reduce exposure through dust management and appropriate working practices.	<b>Negligible/no effect</b> (not significant)

Table 13.13: Summary of assessed Risks related to Construction and Decommissioning phases and assigned potential effects – Electrical Connection route areas

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Human Health – Construction (low)	Negligible/no effect	Construction workers could be affected by potential hazardous ground gases in any buildings or confined spaces. The embedded mitigation reduces the impact and effect.	<b>Negligible/no effect</b> (not significant)

Item & (Sensitivity)	Magnitude of Impact	Justification	Potential Significance of Effect
Groundwater (medium)	Negligible/no effect	The proposed mitigation measures include an outline CoCP ( <b>Document Reference 7.5</b> ) and MMP to be submitted as part of the REP DCO application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects	<b>Negligible/no effect</b> (not significant)
Surface Water (high)	Negligible/no effect	The proposed mitigation measures include an outline CoCP ( <b>Document Reference 7.5</b> ) and MMP to be submitted as part of the REP Development Consent Order (DCO) application and working within best practice guidelines, preventing the release of contamination and therefore negating any effects	<b>Negligible/no effects</b> (not significant)

### Operation/Maintenance

13.9.26 On the basis of the adoption of the embedded mitigation measures described, the following table summarises the potential effects of the operation of the Proposed Development.

Table 13.14: Summary of assessed Risks related to Operation phases and assigned potential effects – REP site

Item (sensitivity)	Magnitude of Impact	Justification	Potential Effect
Human Health – Future Users (medium)	Large Adverse	Future users could be exposed to asbestos within any Made Ground that remains exposed at or close to the ground surface in any proposed soft landscaped areas in the completed development. Future users could be exposed to potential hazardous ground	<b>Major</b> (significant)

Item (sensitivity)	Magnitude of Impact	Justification	Potential Effect
Human Health – Maintenance (low)	Large Adverse	<p>gas concentrations in any buildings or confined spaces.</p> <p>Future users could be exposed to asbestos within any Made Ground that remains exposed at or close to the ground surface in any proposed soft landscaped areas in the completed development.</p> <p>Future users could be exposed to potential hazardous ground gas concentrations in any confined spaces.</p>	<b>Moderate</b> (significant)
Surface Water (high)	Negligible/no effect	<p>It is anticipated that REP would be operated in accordance with the Applicant’s existing and new Environmental Permit and an operational phase environmental code of practice which would provide systems of work and mitigation measures to prevent the impacts of contamination of the surface water ditches and dykes surrounding the site and by extension, the River Thames.</p>	<b>Minor</b> (not significant)
Property – Buildings (low)	Large Adverse	<p>Concentrations of potential hazardous ground gases could accumulate in existing and new buildings at the site.</p>	<b>Moderate</b> (significant)
Property – Animal or Crop (low)	Negligible/no effect	<p>It is anticipated that REP would be operated in accordance with the Applicant’s existing and new Environmental Management Systems (Environmental Permit and an operational phase environmental code of practice) which would provide systems of work and mitigation measures to prevent off site impacts.</p>	<b>Negligible/no effect</b> (not significant)

Item (sensitivity)	Magnitude of Impact	Justification	Potential Effect
Ecological Systems (medium)	Negligible/no effect	It is anticipated that REP would be operated in accordance with the Applicant’s existing and new Environmental Management Systems (Environmental Permit and an operational phase environmental code of practice) which would provide systems of work and mitigation measures to prevent the impacts of contamination of the surface water ditches and dykes surrounding the site and by extension the adjacent Nature Reserve and the River Thames.	<b>Negligible/no effect</b> (not significant)

### 13.10 Cumulative Assessment

13.10.1 Construction of REP could occur simultaneously with some or all of the ‘other developments’ identified for cumulative assessment. The ‘other developments’ with the most potential for cumulative effects generally are identified in **Chapter 4**, and **Appendix A.4**.

13.10.2 With reference to the potential for cumulative effects in relation to ground conditions, the zone of influence within which the ‘other developments’ have been considered has been defined as 1 km from the REP site, on the south side of the River Thames. It is considered that beyond this zone, the significant potential variations in geological profile, groundwater conditions and potential pathways result in potential impacts that are anticipated to have Negligible/no effects.

13.10.3 The thresholds within the zone of influence (ZOI) that have been used to determine ‘other developments’ with the potential for cumulative effects in relation to ground conditions have been based on the source-pathway-receptor approach for assessing effects in relation to ground conditions, and therefore whether the proposals in the ‘other developments’ could result in a significant cumulative effect through the introduction of a new source or pathway to a new or identified receptor.

13.10.4 REP has been designed to be CHP enabled, meaning that there is the potential to supply waste heat generated from the combustion process to a local heat off-taker. It is acknowledged that any future supply of waste heat (e.g. to district heat network scheme for a local residential area) could result in impacts to the local environment. However, given the nature of any such scheme (likely to consist mainly of a network of buried pipes) any impacts would be limited to the

temporary construction phase which is unlikely to overlap with construction of REP. Given that the network would most likely serve the local Thamesmead/Peabody area, impacts would likely be restricted to existing brownfield urbanised land (e.g. burying pipes in roads). Such temporary impacts would be subject to a separate planning application which is anticipated to be bound by a CoCP or similar best practice working methods. It is therefore considered highly unlikely that there would be any likelihood of significant cumulative effects.

### Construction/Decommissioning

13.10.5 Construction phase mitigation measures would be employed during the construction of the Proposed Development, which would have been reviewed by and agreed with the regulatory authorities, and would be contained within the CoCP and other embedded mitigation. The effects relating to ground conditions and contamination are site specific and therefore the mitigation measures would also be site specific. Assuming that the 'other developments' are subject to review through the planning regime and would incorporate their own site specific mitigation measures, as required, then it is anticipated that there would be **No effects** in relation to cumulative construction impacts to ground conditions, even in the unlikely scenario of simultaneous construction of all of the 'other developments' within the zone of influence and meeting the defined thresholds.

13.10.6 It is assumed for the purposes of this assessment that the REP generating equipment would be removed once the plant had ceased operations permanently. Any decommissioning phase is assumed to be of a similar or shorter duration to construction, and therefore environmental effects are considered to be of a similar level to those during the construction phase. It is assumed that the ducting for the Electrical Connection would remain in situ, but that the cables may be removed.

### Operation/Maintenance

13.10.7 The operation of REP could occur simultaneously with some or all of the relevant 'other developments' located in the ZOI for Ground Conditions. Operational phase mitigation measures would be employed during the operation of REP, and it is assumed that each specific 'other development' would also be required to apply operational phase mitigation measures in relation to potential contamination, as appropriate. As such, significant adverse cumulative operational effects are not anticipated in relation to ground conditions, even in the eventuality of simultaneous operation of all of the 'other developments' within the ZOI and meeting the defined thresholds.

## 13.11 Further Mitigation and Enhancement

### Construction/Decommissioning

13.11.1 **Appendix I.2** contains an Outline Remedial Strategy (ORS) that identifies the requirement for additional intrusive ground investigation, data collection and analysis to refine the preliminary ground gas risk assessment and enable



specific personal protection measures for construction workers to be defined (if required). The ORS also provides preliminary mitigation options for the protection of human health (end users) and buildings, including measures to be incorporated into the design of the structures for the Proposed Development. Following completion of the additional ground investigation, monitoring and assessment (which is currently being undertaken to inform the design of buildings at the REP site), the ground gas risk assessment will be refined and the mitigation measures to be adopted, including any specific personal protection measures will be included in the Remediation Strategy that forms part of the final CoCP.

- 13.11.2 The ORS provides preliminary mitigation measures for the protection of human health (end users) in relation to asbestos in the Made Ground, in the form of a clean cover system to be provided in areas of soft landscaping in the Proposed Development. Following further assessment and review of the areas where Made Ground will remain in place below soft landscaped areas, the details of the clean cover system will be included in the Remediation Strategy that forms part of the final CoCP.
- 13.11.3 The ORS provides preliminary recommendations for specific personal protection measures for construction workers during excavations and ground disturbance works in the Made Ground at the REP site, and recommends further investigation and sampling to confirm the preliminary assessment. Once the additional investigation, sampling and assessment has been undertaken, the final specific personal protection measures required will be included in the Remediation Strategy that forms part of the final CoCP.
- 13.11.4 Any structures or confined spaces proposed will incorporate appropriate ground gas protection measures in accordance with appropriate investigation, monitoring and assessment (if required).
- 13.11.5 The requirements for additional investigation (to be undertaken prior to construction), data collection, analysis and assessment to inform the final CoCP, and MMP would be secured as a Requirement of the DCO.

### **Operation/Maintenance**

- 13.11.6 Additional mitigation and enhancement beyond that described above for the construction phase is not anticipated to be required at this stage. The construction mitigation items also remove the likelihood for significant effects to arise from the operation of the Proposed Development.

## **13.12 Residual Effects and Monitoring**

- 13.12.1 Residual effects are those that are predicted to remain after implementation of the Further Mitigation and Enhancement described above. The residual effects in relation to ground conditions and land contamination, relative to the construction and operation of the Proposed Development have been assessed and are presented in this section.

### Summary of Residual Effects

13.12.2 The tables below summarise the potential residual effects at the REP site, the Main Temporary Construction Compound and the Data Centre site.

Table 13.15: Summary of Residual Effects – the REP site

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
Construction / decommissioning	Human Health – Construction	<p>Mitigation measures to reduce exposure to asbestos by use of appropriate PPE (standard and specific, e.g. respiratory equipment) and good work practices e.g. dust suppression.</p> <p>Mitigation measures to reduce exposure to accumulations of hazardous ground gases by use of appropriate PPE (standard and specific), good work practices, and appropriate protection measures to be included in the construction of the Proposed Development if required (e.g. structural barrier, gas resistant membrane, pressure relief system).</p>	<b>Negligible/no effect</b>
	Human Health – Site Users	<p>The proposed construction (embedded mitigation) will remove or cap some asbestos affected Made Ground with permanent cover.</p> <p>Mitigation measures to reduce exposure to asbestos including good working practices (e.g. appropriate dust suppression).</p>	<b>Negligible/no effect</b>

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
		Mitigation measures to reduce exposure to accumulations of hazardous ground gases by the adoption of appropriate protocols and good work practices in accordance with the embedded mitigation.	
	Human Health – Off-site	Mitigation measures will reduce exposure through appropriate dust management and appropriate working practices during construction, in accordance with the CoCP.	<b>Negligible/no effect</b>
	Property – Animal or Crop		
	Property - Buildings	New buildings will be constructed with appropriate ground gas protection measures, in accordance with the proposed Remediation Strategy.	<b>Negligible/no effect</b>
	Groundwater	Appropriate pile design with associated FWRA in accordance with the CoCP.	<b>Negligible/no effect</b>
	Surface Water	Working within best practice guidelines, in accordance with the CoCP to prevent the release of any contamination.	<b>Negligible/no effect</b>

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
Construction / decommissioning	Ecological Systems	Mitigation measures to reduce exposure through dust management and good working practices, in accordance with the CoCP.	<b>Negligible/no effect</b>
Operation	Human Health – Maintenance	<p>The proposed construction (embedded mitigation) will remove or cap some asbestos affected Made Ground with permanent cover.</p> <p>In areas of soft landscaping where Made Ground material is to remain in place, a clean cover system would be provided, in accordance with the proposed Remediation Strategy.</p> <p>Appropriate ground gas protection measures would be incorporated into the construction of the Proposed Development and protocols will be adopted for maintenance workers in confined spaces.</p>	<b>Negligible/no effect</b>
	Human Health – Site Users	The proposed construction (embedded mitigation) will remove or cap some asbestos affected Made Ground with permanent cover.	<b>Negligible/no effect</b>

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
		<p>In areas of soft landscaping where Made Ground material is to remain in place, a clean cover system will be provided, in accordance with the proposed Remediation Strategy.</p> <p>Removal in part (by construction) of alluvium/peat in areas of deeper construction reduces gassing potential as a consequence of localised source removal.</p> <p>Appropriate ground gas protection measures will be incorporated into the construction of the Proposed Development.</p>	
	Property – Animal or Crop	REP would be operated in accordance with an Environmental Management System which would prevent off site impacts.	<b>Negligible/no effect</b>
	Property – Buildings	New buildings would be constructed with appropriate ground gas protection measures, in accordance with the Remediation Strategy.	<b>Negligible/no effect</b>
	Surface Water		<b>Negligible/no effect</b>

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
	Ecological Systems	It is anticipated that REP would be operated in accordance with the Applicant's existing and new Environmental Management Systems which would provide systems of work and mitigation measures to prevent the impacts of contamination of the surface water ditches and dykes surrounding the site and by extension the adjacent Nature Reserve and the River Thames.	<b>Negligible/no effect</b>

Table 13.16: Summary of Residual Effects – Main Temporary Construction Compound

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
Construction / decommissioning	Human Health – Construction	Mitigation measures to reduce exposure to accumulations of hazardous ground gases by use of appropriate PPE (standard and specific), good work practices in accordance with the CoCP, and appropriate protection measures in confined spaces, as required.	<b>Negligible/no effect</b>

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
	Human Health – Site Users	Mitigation measures to reduce exposure to accumulations of hazardous ground gases by use of appropriate PPE (standard and specific), good work practices in accordance with the CoCP, and appropriate protection measures in confined spaces, as required.	<b>Negligible/no effect</b>
	Property – Animal or Crop	Mitigation measures to reduce exposure through appropriate dust management and good working practices during construction, in accordance with the CoCP.	<b>Negligible/no effect</b>
	Groundwater	Working within best practice guidelines, in accordance with the CoCP to prevent the release of any contamination.	<b>Negligible/no effect</b>
	Surface Water		<b>Negligible/no effect</b>
	Ecological Systems	Mitigation measures to reduce exposure through dust management and good working practices, in accordance with the CoCP.	<b>Negligible/no effect</b>

Table 13.17: Summary of Residual Effects – Data Centre Site

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
Construction / decommissioning	Human Health – Construction	Mitigation measures to reduce exposure to accumulations of hazardous ground gases by use of appropriate PPE (standard and specific), good work practices in accordance with the CoCP, and appropriate protection measures in confined spaces, as required.	<b>Negligible/no effect</b>
	Property – Animal or Crop	Mitigation measures to reduce exposure through appropriate dust and vapour management during construction, in accordance with the CoCP.	<b>Negligible/no effect</b>
	Groundwater	Working within best practice guidelines, in accordance with the CoCP to prevent the release of any contamination.	<b>Negligible/no effect</b>
	Surface Water		<b>Negligible/no effect</b>
	Ecological Systems	Mitigation measures to reduce exposure through dust management and good working practices, in accordance with the CoCP.	<b>Negligible/no effect</b>



Table 13.18: Summary of Residual Effects – Electrical Connection route areas

Stage	Receptor name and description	Mitigation	Assessment of Residual Effects
Construction / decommissioning	Human Health – Construction	Mitigation measures to reduce exposure to accumulations of hazardous ground gases by use of appropriate PPE (standard and specific), good work practices in accordance with the CoCP, and appropriate protection measures in confined spaces, as required.	<b>Negligible/no effect</b>
	Groundwater	Working within best practice guidelines, in accordance with the CoCP to prevent the release of any contamination.	<b>Negligible/no effect</b>
	Surface Water		<b>Negligible/no effect</b>

### 13.13 Summary and Conclusion

- 13.13.1 Following appropriate additional specific ground investigation, monitoring and assessment work, undertaken prior to commencement of construction, appropriate mitigation measures will be included in the construction of the Proposed Development where necessary. These, combined with protocols and specific personal protection measures to be included in the final CoCP, will result in the anticipated potential effects on all sensitive receptors to be **Negligible/no effect**.
- 13.13.2 It is concluded that the potential effects associated with ground, groundwater and surface water contamination and hazardous ground gases, do not pose an unacceptable constraint to the Proposed Development.
- 13.13.3 It is also considered that appropriate design and construction methods used for the development would themselves provide mitigation against many of the potential issues and reduce residual impacts to an acceptable level.

### 13.14 References

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